

LECTURE 15 TO 17

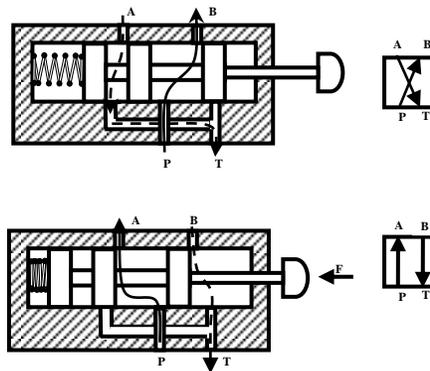
DIRECTIONAL CONTROL VALVES

FREQUENTLY ASKED QUESTIONS

1. Explain briefly the function of directional control valves

- To start, stop, accelerate , decelerate and change the direction of motion of hydraulic actuator
- To permit the free flow from the pump to the reservoir at low pressure, when the pump's deliver is not needed into the system
- To vent the relief valve by either electrical or mechanical control
- To isolate certain branch of circuit

2. Draw a schematic of 4/3 DCV that is direct operated electrically and briefly explain its Function

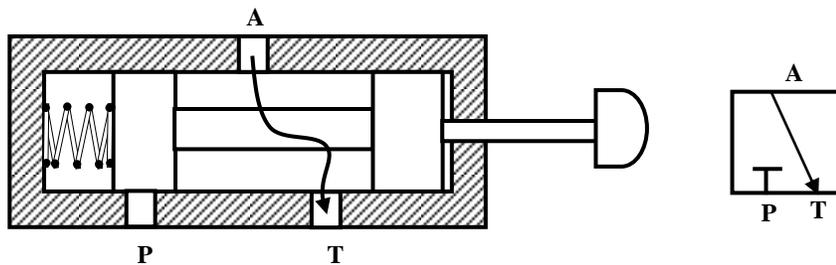


Four way DCV are capable of controlling double acting cylinders and bi-directional motors. Figure shows the operation of a typical 4/2 DCV. A four way has four ports labeled P,T A & B. Pis the pressure inlet and T is the return to the tank. A & B are outlets to the system. In the normal position, pump flow is sent to outlet B. Outlet A is connected to the tank. In the actuated position, the pump flow is sent to port A and port B connected to the tank T. In four way DCV's two flows of the fluids are controlled at the same time, while 2 way and 3way DCV's control only one flow at a time. Figure (c) shows the complete graphic symbol for a four way two piston DCV.

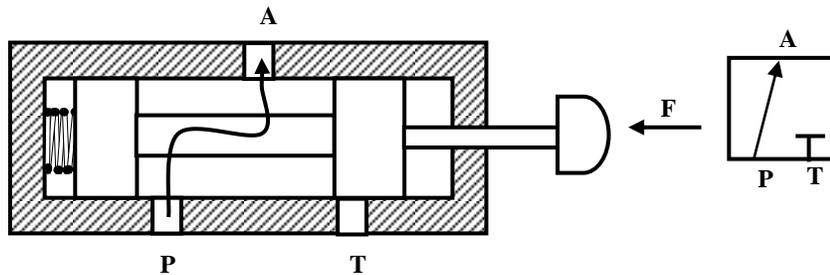
3. Draw a schematic of 3/2 DCV that is manually operated and briefly explain its function

3/2 way DCV (normally closed)

Three way valves either block or allow flow from an inlet to an outlet. They also allow the outlet to flow back to the tank, when the pump is blocked, while a two way valve does not. A three way valve has three ports namely a pressure inlet (P), an outlet to the system (A), and a return to the tank (T). The above figure shows the operation of a 3/2 way 0 valve normally closed. In its normal position the valve is held in position by a spring as shown in figure (A). In the normal position the pressure port P is blocked and the outlet A is connected with the tank. In the actuated position shown in figure (B) the pressure port is connected with the tank and the tank port is blocked.



Port A and T are connected when force is not applied (Valve unactuated)



Port A and P are connected when force is applied (Valve actuated)

4. State the different ways of control of Directional control valves

- i) Manually operated:
- ii) Mechanically operated
- iii) Solenoid operated:
- iv) Pilot operated:

5. How are Directional control valves classified

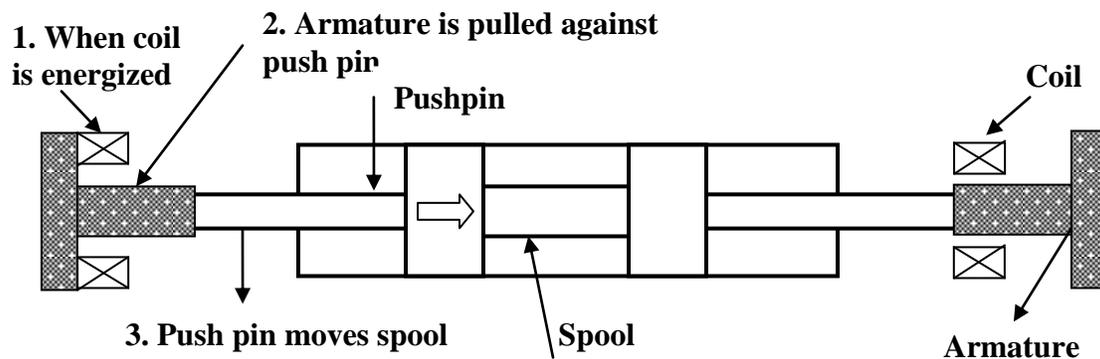
Classification of Direction control valves based on fluid path

- i) Check valves
- ii) Shuttle valves
- iii) 2 way valves
- iv) 3 way valves
- v) 4 way valves

Classification of Direction control valves based on design characteristics

- i) Internal valve mechanism which directs flow of fluid of fluid. Such mechanism can either be a poppet, a ball, a sliding spool, a rotary plug, a rotary disc.
- ii) Number of switching positions (usually 2 or 3)
- iii) Number of connecting ports or ways.
- iv) Method of valve actuation; which causes the valve mechanism to move into alternate position.

6. Explain the construction and operation of electric solenoids and compare the DC and AC solenoids



Like mechanical or pilot actuators, solenoids work against a push pin, which in turn actuates a spool. There are two types of solenoid design used to dissipate the heat developed in electric current flowing in the coil. The first type dissipates the heat into surrounding air and is referred to an "air gap solenoid". In the second type "wet pin solenoid", the push pin contains an internal passage way that allows the tank port oil to communicate between the housing of the valve and the housing of the solenoid. Wet pin solenoids do a better job in dissipating heat because the cool oil represent a good heat sink to absorb heat from the solenoid. As the oil circulates, the heat is carried in to the hydraulic system where it can be easily dealt with.

7. Cite the classification of check valves, and explain the function of pilot operated check valve, giving the necessary drawing.

- Ball valve
- Poppet valve
- Pilot operated
- Shuttle valve

11.1.2 Pilot operated check valve

Pilot operated valve along with its symbol is shown in figure 4. This type of check valve always permits free flow in one direction but permits flow in the normally blocked opposite direction, only if pilot pressure is applied at the pilot pressure point of the valve. The check valve poppet has the pilot piston attached to the threaded poppet stem by a nut.

The light spring holds the poppet seated in a no flow condition by pushing against the pilot piston. The purpose of the separate drain port is to prevent oil from creating a pressure build up on the bottom of the piston. The dashed line in the graphical symbol represents the pilot pressure line connected to the pilot pressure port of the valve. Pilot check valves are used for locking hydraulic cylinders in piston.

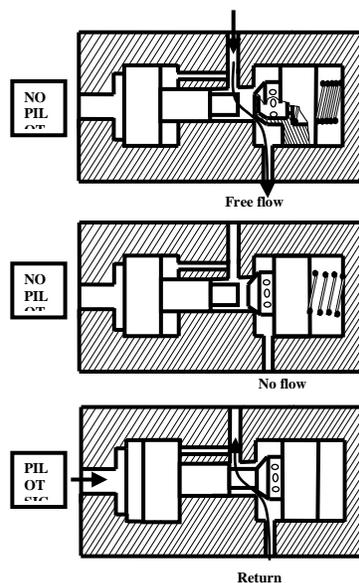


Figure 4 : Pilot operated check valve

8. What is the difference between an open-center and closed-center type of directional control valve?

The open center type connects all ports together when the valve is unactuated . The closed – center design has all ports blocked when the valve is unactuated.

9. What is a shuttle valve? Name one application

A shuttle valve is another type of directional control valve. It permits a system to operate from either of two fluid power sources. One application is for safety in the event that the main pump can no longer provide hydraulic power to operate emergency devices.